The Three-Dimensional Morphology of the Antarctic Ozone Hole

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Abstract

The three-dimensional morphology of the spring antarctic ozone distribution as determined by the Nimbus 7 SBUV instrument is presented for the period 1 to 11 October in 1986. The data show that a clearly defined minimum in ozone relative to the local ozone field extends throughout the stratosphere from the tropopause to above 50 km, though decreasing in intensity with altitude. Near 18 km ozone in the ozone hole is 50% less than the average surrounding ozone. But even at 50 km the ozone is 20% less than the surrounding ozone field. The ozone minimum in the upper stratosphere is displaced about 6 degrees toward the equator so that observations at a fixed station may provide the illusion that the ozone minimum is restricted only to low altitudes. While the ozone minimum is spatially coherent throughout the stratosphere, there are differences in the behavior of ozone at different altitudes that suggest the existence of at least three distinct altitude domains. Below 30 km ozone is characterized by classic "ozone hole" behavior. Between 33 and 43 km ozone is more stable, actually increasing during September and October. Above 43 km ozone has always decreased during September to a minimum in October, but it has suffered a long term decrease of 7-12% since 1979 similar to that seen at low altitudes.